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Quality of western Canadian malting barley

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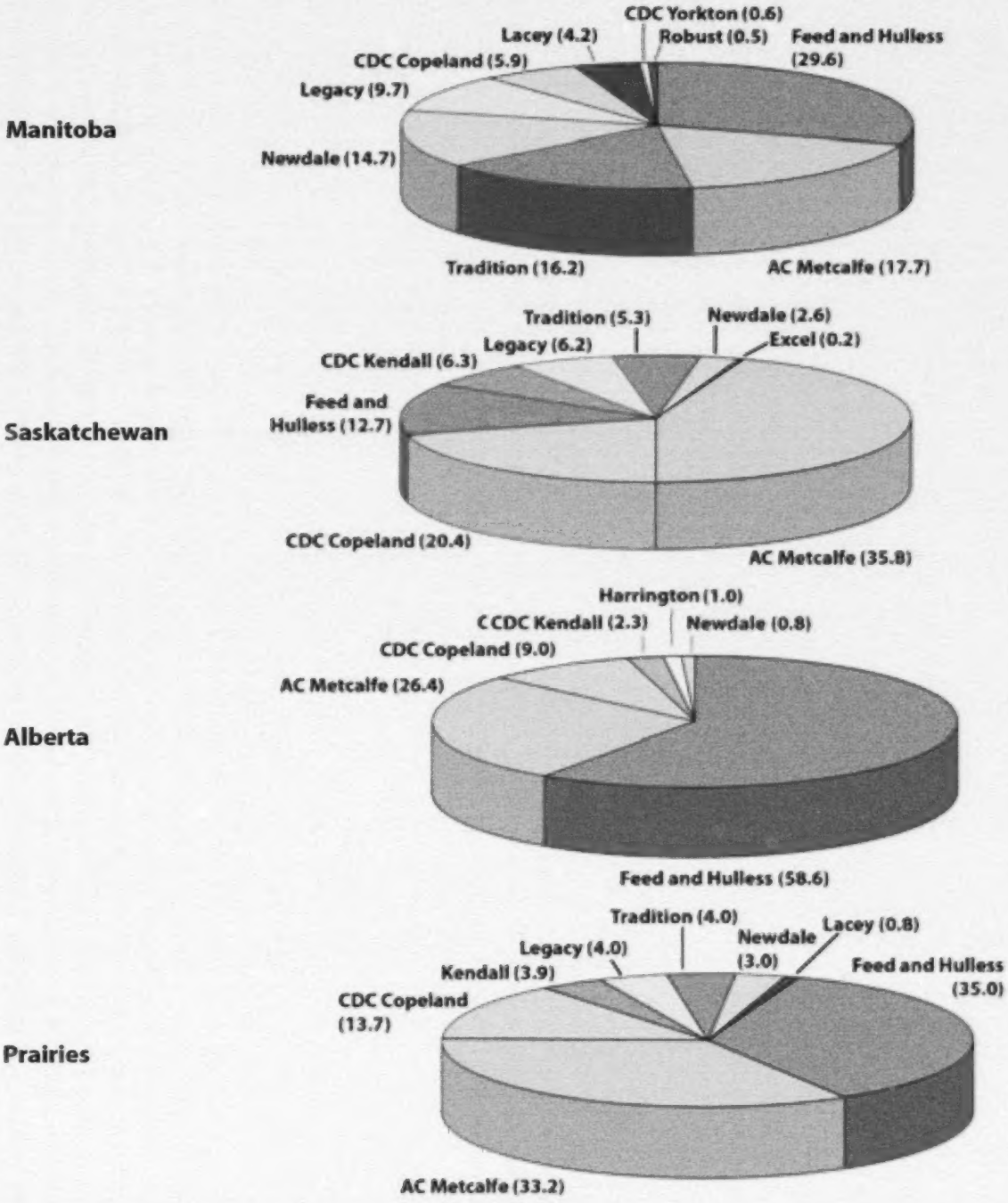
Figure 1 – Distribution of barley cultivars in 2009 by region (as a percentage of total barley seeded acreage)[1]



[1] Data obtained from the CWB Variety Survey 2009.

Quality of western Canadian malting barley 2009

Abstract

The quality data for the 2009 harvest was derived from 102 separate varietal composites, representing a total of 676,068 tonnes of barley selected for malting purposes.

Barley crop volume for 2009, at 8,549,000 tonnes, was 19% lower than the 10-year average of 10,580,000 tonnes. This was largely attributable to a late seeding season, with fewer acres seeded to malting barley. Barley yields, overall, were slightly higher than average.

Manitoba had a slightly above average year for barley crop yield due to relatively early seeding and a long cool growing period. Levels of precipitation through mid-summer were above average, but harvest period became warmer and drier. Elevated levels of fusarium, mold and mildew were present in areas that were excessively wet.

Central and western areas were affected by dry conditions entering the spring, combined with dry and cool conditions throughout the months of May and June. Delayed planting combined with cool temperatures and dry conditions slowed crop development in central and northern areas. Eastern areas received moderate amounts of rainfall, while in western areas the dry trend persisted. The Peace River region of Alberta and British Columbia was dry and the only region to experience above normal temperatures. Crop development in most areas remained 2 to 3 weeks behind normal throughout summer. Dry and warm conditions in the Prairies during September allowed the crop to mature and harvest to progress rapidly. Yields and quality improved in eastern areas, while persistent dryness limited yields in western areas.

Malting barley selected in 2009 was of above average quality. Thousand kernel weights and kernel plumpness levels were above long term averages. Protein levels were the lowest seen in more than a decade. Barley colour and appearance in 2009 was affected by excess moisture during the growing season. Barley germination energy levels in 2009 were similar to those of 2008, however RVA values were optimal(high), indicating very low incidence of pre-germination. Dormancy was present at normal levels in some six-rowed varieties, with limited water sensitivity present in most samples.

Malt made from 2009 barley was of above average quality with elevated levels of extract, good enzyme level , moderate protein modification, and acceptable levels of wort beta-glucan and viscosity. Endosperm modification rates were moderate but even, allowing for good brewing performance.

Overall, the 2009 malting barley crop was of above average quality.

Introduction

The 2009 malting barley survey is the 22nd consecutive survey conducted in this general format. The report is dependant on receipt of representative varietal composite samples which have been selected for domestic processing or for export as malting barley. Industry participation in preparing and submitting these composites is essential for completion of a successful survey. Submitted barley samples are analysed for quality and then micromalted. Malt quality is analysed using ASBC standard methods of analysis.

This report contains a discussion of the heritage and characteristics of the major varieties, which make up the portfolio of malting barley varieties currently being grown and selected in Canada. In the past two decades there have been significant changes in the types grown, their quality profiles, and in the varieties selected for malting purposes. (Tables 1 and 2, and Figure 1)

Table 1 – Malting barley cultivars recommended for production in western Canada by the CMBTC, its members, and others in the Canadian barley industry (2010-2011)

Recommended two-rowed malting varieties

Variety	Domestic	Export	Market outlook
AC Metcalfe	Established	Established	Stable, high demand
CDC Copeland	Established	Established	Stable demand
CDC Kendall	Established	Established	Stable demand
Newdale	Limited	Limited	Stable demand

Recommended six-rowed barley varieties

Variety	Domestic	Export	Market outlook
Legacy	Established	Established	Declining demand
Tradition	Established	Established	Declining demand
Stellar-ND	Limited	Limited	Increasing demand

Table 2 – Seeded acres of malting barley cultivars (as a percentage of total area seeded to malting barley)[1]

Two-rowed cultivars	2009	2008	2005-2009 average	Six-rowed cultivars	2009	2008	2005-2009 average
AC Metcalfe	51.0	45.7	49.0	Legacy	6.2	8.8	7.0
CDC Copeland	21.1	18.7	15.5	Tradition	6.3	6.4	3.2
CDC Kendall	5.9	9.2	10.1	Excel	0.2	1.2	2.0
Newdale	4.7	4.6	3.2	Robust	0.4	0.4	1.6
Harrington	1.3	1.5	3.4	Lacey	1.2	1.6	1.5
Merit	0.1	0.2	0.8	CDC Yorkton	0.3	0.5	0.3
Other	0.5	0.6	0.8	CDC Battleford	0.1	0.2	0.2
Stein	0.0*	0.0*	0.5	Other	0.5	0.1	0.2

[1] Data obtained from the CWB Variety Survey 2009.
* negligible amounts

AC Metcalfe, a cross of Oxbow x Manley, was fully registered in 1997, and was crossed by Dr. R. Metcalfe at AAFC Winnipeg, and by Dr. W. Legge at AAFC Brandon. It has higher yield and earlier maturity than Manley, with good disease resistance and lodging resistance. Malting characteristics include improved peeling resistance, higher extract levels, higher enzyme levels, low wort beta-glucan, and faster modification rates. These factors translate into good brewing performance, with fast lautering and conversion times, and suitability for use in higher adjunct brewing. AC Metcalfe is now the most widely grown two-rowed variety, occupying over 50% of all malt barley acreage.

CDC Copeland, a two-rowed cross of WM861-5/TR118, registered in 1999, was developed by Dr. B. Harvey, Crop Development Centre, University of Saskatchewan. It is a high yielding, early maturing variety, with good resistance to disease and lodging. CDC Copeland processes easily and modifies similarly to Harrington, with similar extract and enzyme levels, but has lower levels of soluble protein, colour, and wort beta-glucan than Harrington. It has good overall brewing characteristics, and with its quality and lower modification profile, provides an excellent balance within the portfolio of malting barley varieties. CDC Copeland production levels now exceed 20% of total malting barley production.

CDC Kendall, a cross of Manley x SM85221, was registered in 1999, and was developed by Dr. B. Harvey, Crop Development Centre, University of Saskatchewan. It has higher yield, average maturity, and good lodging and shattering resistance compared to standard two-rowed check varieties. CDC Kendall has good resistance to peeling, average extract and soluble protein, and higher enzyme levels. It has very low wort beta-glucan and modification similar to Harrington. CDC Kendall is seen as a suitable replacement for Harrington, but with much higher DP, which also makes it suitable for higher adjunct brewing. Improved husk retention also helps with filtration in the lautering vessel. CDC Kendall has declined gradually to a production level of 6% of malt barley acreage.

Newdale, a two-rowed cross of CDC Stratus/TR 236, was fully registered in 2001, and was developed by Dr. W. Legge, AAFC Brandon Research Centre. Newdale is now being grown in significant quantities particularly in the eastern half of the Prairies. It has excellent yield, is one day later than AC Metcalfe in maturity, has good disease resistance and good lodging resistance. Newdale has improved peeling resistance, increased friability, good enzyme and soluble protein levels, low wort beta-glucan, and fast modification. It also has fast conversion times and fast lautering in the brewhouse. Its very low wort beta-glucan content makes Newdale attractive to brewers who experience slow runoffs and poor beer filtration.

Legacy, a six-rowed barley, a cross of Excel/Bumper/Karl/Manker, was registered in 2002, and was developed by Dr. B. Cooper, Busch Agricultural Resources Inc., Ft. Collins, CO, USA. It has very good yield potential, maturity similar to CDC Sisler, 2-3 days later than Robust, and 1 day later than Excel. Legacy has fair lodging resistance, low grain protein, and better disease resistance than most other six-rowed varieties. Malt characteristics include higher extract and enzyme levels, lower wort beta-glucan, and faster modification rates. Legacy has shown satisfactory brewhouse performance, with fast conversion times and satisfactory lautering times. Legacy's high enzyme package makes it ideal for high adjunct brewing. Legacy now occupies roughly 40% of acreage devoted to six-rowed malting barley in western Canada.

Tradition, a six-rowed barley, a cross of 6B89-2126/ND10981, received full registration in Canada in 2004. It was developed by Dr. B. Cooper, Busch Agricultural Resources Inc., Ft. Collins, CO, USA. Tradition has good yield potential, better kernel plumpness, and better lodging resistance than B1602 or CDC Sisler. Tradition has higher extract, and higher levels of DP with adequate alpha amylase levels, when compared to B1602 or CDC Sisler. Soluble protein levels are intermediate between B1602 and CDC Sisler. Tradition has satisfactory brewhouse performance, with fast conversion times and satisfactory lautering times. Its higher enzyme package makes it ideal for high adjunct brewing, similar to Legacy. Tradition now occupies approximately 40% of six-rowed malting barley acreage in western Canada.

Growing and harvesting conditions

The western half of the Prairies entered the planting season under drought conditions, thus delaying planting until moisture was available. Soil moisture levels in the eastern prairies were better, but lack of early precipitation and cool temperatures delayed planting by 1- 2 weeks.

The early spring season was very cool resulting in delayed seeding in some areas and resulted in poor germination and crop emergence in early seeded areas. Moderate precipitation fell in southern and eastern areas during late-April and early May, however continued cool temperatures resulted in poor germination and slow growth. Northern areas experienced a late snow melt, and thus a delayed seeding period.

Temperatures in May and June were below normal throughout most of the Prairie region, making crop development two to three weeks behind normal entering July. Moderate temperatures in July throughout most of the Prairies allowed the crops to mature with limited stress. The exception was the Peace River region, where above nomal temperatures resulted in some loss of yield. .

Cool temperatures throughout the prairie region and continued dryness in western areas slowed crop development during the growing period. Cooler temperatures allowed the crop to move through the reproductive stage with limited stress. Precipitation amounts increased slightly in August, improving prospects in most regions. September brought warm dry conditions to the prairies, which advanced crop maturity, and allowed harvest to progress rapidly. Quality also was maintained as dry weather persisted through the end of September. Cooler than normal temperatures combined with rain and snow events during October slowed harvest to a standstill in central and northern areas.

Production, yields and quality

The area seeded to barley in western Canada decreased by 21% in 2009. Crop yields were slightly below average, resulting in a 20% drop in production levels relative to 2008. Total production was 16% lower than the 10 year average for Western Canada (Table 3). Variable weather conditions across the prairies resulted in pockets with good yield and barley quality, and other areas where yields and quality were compromised by adverse weather. Protein and plumpness levels were at optimum levels due to moderate temperature, adequate moisture, and an extended growing season in several regions. Germination energy characteristics were good, with little evidence of water sensitivity. Colour and appearance were affected somewhat in 2009, due to cool, moist conditions in most of the prairies, however, that had little carry through effect upon malt quality.

Western Canadian malting barley selections exhibited very little tendency toward pre-germination in 2009. Rapid visco analysis (RVA) indicated over 86% of the crop was sound barley (RVA values >110) with excellent potential for storage. Les than 13% of the barley had moderate pre-germination (50-110 RVA units) with good potential for storability provided appropriate conditions were used and grain moistures were low (<12%). Less than 1% of the crop was severely pre-germinated (RVA < 50), a significant improvement over recent harvests.

Table 3 – Barley production in western Canada for 2009, 2008 and the 2000-2009 average[1]

	Seeded area			Production		
	2009	2008	2000-2009 average	2009	2008	2000-2009 average
	thousand hectares			thousand tonnes		
Manitoba	263	330	403	893	1121	1166
Saskatchewan	1437	1538	1828	3877	4594	4166
Alberta[2]	1645	1709	1980	3779	5495	4879
Total	**3345**	**3577**	**4211**	**8549**	**11209**	**10211**

[1] Statistics Canada, *Field Crop Reporting Series, No. 7*, October 2009
[2] Alberta figures include small amounts grown in British Columbia

Table 3 shows the following:

- Total seeded acreage was 21% lower than ten-year average levels.
- Total barley production in western Canada was 24% lower than 2008.
- Total production of barley in 2009 was 16 % lower than ten-year average levels.
- Alberta's production was 31% lower on 4% fewer seeded hectares.
- Saskatchewan production decreased by 16%, on 7% fewer seeded hectares.
- Manitoba's production decreased by 21%, on 20% fewer seeded hectares.

Sampling and general crop quality

The 2009 malting barley survey was based on 676,068 tonnes of malting barley selected for purchase by Busch Ag Resources Inc., Cargill Grain Co. Ltd., Canada Malting Co.Ltd., Richardson Co. Ltd., Prairie Malt Co. Ltd, Parrish and Heimbecker Co. Ltd., Rahr Malting Co. Ltd., and Viterra Co. Ltd. The total tonnage included in this survey represented a large percentage of the total volume of malting barley selected in western Canada through mid-October. Due to late harvesting and slow market uptake conditions, malt barley selection continued well beyond this survey's cutoff date.

Selectors from these companies sent separate one-kilogram composites of barley to the Applied Barley Research Unit of the Grain Research Laboratory. Composites were based upon cultivar, province or region, tonnage, and selection period. Samples were received from the beginning of harvest until the 18th of October, at which time composite sample receival was terminated.

Samples received at the GRL were kept unique, and not further composited.

Malting quality data

The 2009 malting barley harvest produced lower volumes as anticipated, given the reduced seeded acreage across western Canada. Climatic and growing conditions improved during the growing season, but generally too late to significantly affect the volume of malting barley produced. The general quality of the malt produced from this season's barley was above average. The barley had low protein levels, with good kernel weight and plumpness levels. Germination energies were good, with limited evidence of water sensitivity. Micromalting test runs indicated water uptake rates and modification rates were normal, so that minimal changes to existing malting schedules could produce good quality malt. It should be noted that the malting schedule chosen was optimized for two-rowed rather than six-rowed type barleys. Micromalting tests using the chosen malting schedule, resulted in steep out moisture levels that were near optimum, indicating that the barley absorbed water at a normal rate, with little effect from water sensitivity. Chitting profiles at steep out and during germination were normal for most varieties. (See the Methods section at the end of this bulletin for the complete malting schedule).

This year's study resulted in malts with improved levels of extract, lower levels of protein modification, and moderately low beta-glucan levels. Soluble protein and free amino nitrogen levels were slightly lower than average for most varieties, while enzyme levels were more than adequate. Modification rates were near optimum, as the balance in quality analysis indicates.

AC Metcalfe

AC Metcalfe barley in 2009 had good quality characteristics. Thousand kernel weights and plumpness levels were similar to those of 2008 (Table 4). Protein levels were 0.4 % lower than 2008 on average. Germination energy levels were good, with little water sensitivity evident. RVA levels indicated virtually no pregermination was present. Barley colour and appearance were slightly affected by moderate levels of staining.

The quality of malt made from composites of selected AC Metcalfe barley was of above average quality due to several factors that have positive effects upon malt modification. Those are low protein level, high plumpness, vigorous germination rate, and even protein modification. Friability levels were lower in 2009, due primarily to slight undermodification of the malt. Malt extract levels in 2009 were on average 0.2% higher than those of 2008. Beta-glucan levels in wort were slightly higher than those of 2008, while wort viscosity levels were similar to 2008. Protein modification levels were slightly lower in 2009, as indicated by lower levels of soluble protein, lower Kolbach indices, and lower wort colour. Free amino nitrogen levels were lower than those of 2008, due primarily to lower protein modification. Diastatic power and alpha amylase levels, despite lower overall modification, were significantly higher in 2009 compared to the levels of 2008.

Table 4 – Quality data for 2009 harvest survey composite samples of AC Metcalfe malting barley

Origin of selected samples	Alberta/ Sask	Saskatchewan		Alberta		Prairie Provinces[1]	
Crop year	2009	2009	2008	2009	2008	2009	2008
Thousands of tonnes	215	119	449	61	264	395	715
Barley							
Physical characteristics							
Test Weight, Kg/hL	67.1	67.1	n/a	68.0	n/a	67.3	n/a
1000 kernel weight, g	43.8	45.3	44.8	44.9	45.7	44.4	45.2
Heavy grade, over 6/64" sieve, %	93.2	93.6	93.5	94.5	93.6	93.5	93.5
Intermed grade, over 5/64"sieve, %	5.2	4.7	4.8	4.2	6.5	4.9	5.4
Chemical analysis							
Moisture, %[2]	10.3	13.2	10.9	12.2	11.4	11.5	11.1
Protein, %	11.2	11.2	11.7	11.3	11.5	11.2	11.6
Germination, 4 ml (3 day), %	99	99	99	100	98	99	99
Germination, 8 ml (3 day), %	92	92	91	93	92	92	91
Malt							
Physical characteristics							
Yield, %	93.9	94.1	93.3	94.0	93.1	94.0	93.2
Steep-out moisture, %	45.6	46.0	48.5	45.3	48.0	45.7	48.3
Friability, %	72.8	75.0	76.2	74.6	74.0	73.7	75.4
Chemical analysis							
Moisture, %	5.3	5.1	4.8	4.9	5.0	5.2	4.9
Wort							
Fine grind extract, %	80.3	80.3	79.8	80.4	80.0	80.3	79.9
Coarse grind extract, %	79.8	79.8	79.4	79.7	79.5	79.8	79.4
F/C difference, %	0.5	0.5	0.4	0.7	0.5	0.5	0.5
ß-Glucan, ppm	71	85	54	88	58	78	56
Viscosity, cps	1.42	1.43	1.43	1.42	1.43	1.43	1.43
Soluble protein, %	4.47	4.43	4.79	4.41	4.69	4.45	4.76
Ratio S/T, %	39.4	39.6	40.9	38.7	40.1	39.4	40.7
FAN, mg/L	170	169	201	169	199	170	200
Colour, ASBC units	1.75	1.80	2.27	1.75	2.21	1.76	2.25
Diastatic power, °L	162	166	137	165	137	164	137
α-amylase, D.U.	71.3	69.3	64.9	67.1	64.1	40.1	64.6
Rapid Visco Analysis, units	90	137	86	134	100	111	91

[1] Weighted average values

[2] Moisture not representative of new crop moisture levels as samples were not collected or stored in moisture-proof containers.

CDC Copeland

CDC Copeland is the second major two-rowed malting variety grown on the prairies (Table 5). Its acreages and selection rates have continued to increase. The barley composites of CDC Copeland received at the GRL in 2009 were of good quality. Levels of thousand kernel weight and plumpness were similar to the levels in 2008. Protein levels were very good, lower than those in 2008. Germination energy levels were good, with no water sensitivity evident in the composites. RVA values indicated that no pregermination was present in the composite samples. Barley colour, in general, was good, with moderate levels of staining.

The malt made from composites of CDC Copeland in 2009 was of slightly above average quality, attributable to the barley quality factors of protein level, plumpness, germination rate, and even modification. Friability levels were normal, while extract levels were on average 0.5% higher than those of 2008. Beta-glucan and wort viscosity levels were low, similar to levels of 2008. Protein modification indices were moderate, with soluble protein values slightly lower than those measured in 2008. Wort colour and FAN levels were slightly lower in 2009, due to lower barley protein modification levels. Diastatic power and alpha-amylase levels were higher than those of 2008, despite the lower overall protein modification.

Table 5 – Quality data for 2009 harvest survey composite samples of CDC Copeland malting barley

Origin of selected samples	Manitoba		Saskatchewan		Alta/ Sask	Alberta		Prairie Provinces[1]	
Crop year	2009	2008	2009	2008	2009	2009	2008	2009	2008
Thousands of tonnes	2	3	46	151	67	6	78	121	232
Barley									
Physical characteristics									
Test Weight, Kg/hL	66.1	n/a	66.3	n/a	68.2	66.7	n/a	67.4	n/a
1000 kernel weight, g	49.0	47.4	47.0	46.8	47.2	47.6	46.9	47.1	46.8
Heavy grade, over 6/64" sieve, %	95.4	94.5	94.3	94.1	95.5	95.2	94.2	95.0	94.1
Intermed grade, over 5/64"sieve, %	3.6	3.7	4.3	4.3	3.5	3.7	4.3	3.8	4.3
Chemical analysis									
Moisture, %[2]	12.5	10.8	13.4	11.7	11.1	12.0	11.6	12.0	11.7
Protein, %	11.0	11.4	10.9	11.3	10.6	11.6	11.3	10.8	11.3
Germination, 4 ml (3 day), %	100	98	99	98	99	100	99	99	99
Germination, 8 ml (3 day), %	99	92	94	96	98	98	96	97	96
Malt									
Physical characteristics									
Yield, %	94.6	93.5	94.3	93.6	93.8	94.1	93.6	94.0	93.6
Steep-out moisture, %	46.0	49.1	45.8	48.2	45.5	45.8	47.9	45.6	48.1
Friability, %	84.9	81.2	82.0	89.8	81.6	75.8	86.0	81.5	88.4
Chemical analysis									
Moisture, %	4.8	4.8	4.8	4.6	5.1	4.9	4.7	5.0	4.6
Wort									
Fine grind extract, %	79.7	79.4	79.9	79.3	80.0	79.3	79.2	79.9	79.3
Coarse grind extract, %	79.4	79.2	79.6	79.0	79.4	79.1	78.9	79.5	79.0
F/C difference, %	0.3	0.2	0.3	0.3	0.6	0.2	0.3	0.4	0.3
ß-Glucan, ppm	75	25	80	47	66	76	59	72	51
Viscosity, cps	1.44	1.42	1.43	1.40	1.42	1.43	1.43	1.42	1.43
Soluble protein, %	4.34	4.95	4.35	4.60	4.45	4.51	4.52	4.41	4.59
Ratio S/T, %	39.0	41.4	39.3	39.9	39.7	38.1	39.8	39.4	39.9
FAN, mg/L	159	224	158	184	159	161	177	159	182
Colour, ASBC units	1.91	2.49	1.81	2.00	1.62	1.85	1.92	1.71	1.96
Diastatic power, °L	137	125	137	124	139	141	122	138	123
α-amylase, D.U.	55.7	50.8	52.1	49.9	56.0	51.5	46.2	54.3	48.7
Rapid Visco Analysis, units	155	61	142	111	135	145	101	139	107

[1] Weighted average values

[2] Moisture not representative of new crop moisture levels as samples were not collected or stored in moisture-proof containers.

CDC Kendall

CDC Kendall barley in 2009 was of good average quality (Table 6). Plumpness and thousand kernel weight levels were similar to those of 2008. Protein levels were very good, averaging about 0.5 % lower than those in 2008. Germination energy levels were good, with slight water sensitivity present in some samples. CDC Kendall barley grown in 2009 had moderate levels of colour and staining.

Malted composites of selected CDC Kendall barley in 2009 had quality characteristics that were improved over 2008 CDC Kendall malt. Extract levels were on average 0.7% higher than those of 2008, with beta-glucan and viscosity levels simlar in magnitude. Soluble protein and FAN values were slightly lower in 2009. Wort colour levels were lower than those measured in 2008 CDC Kendall malt. Diastatic power and alpha amylase levels were higher than levels of 2008.

Newdale

Newdale is included in this survey for the third year in 2009 (Table 6). Selected tonnages of this variety are low, but are increasing. Newdale barley grown in 2009 had slightly lower levels of thousand kernel weight and plumpness, compared to 2008 (Table 6). Protein levels were good, slightly higher than those in 2008. Germination energy levels were very good, with evidence of some water sensitivity. Barley appearance was average, with moderate levels of staining present.

The malt made from Newdale barley in 2009 was of good quality, with a similar quality profile to that of 2008 malt. Extract levels were similar to those of 2008. Beta-glucan and viscosity levels were moderately low. Protein modification was moderate, slightly lower than levels found in 2008 Newdale malt. FAN levels as well as wort colour were lower than levels in 2008. Diastatic power and alpha amylase levels were moderate, somewhat improved over levels in 2008. Overall, malt made from 2009 Newdale barley was of good average quality, similar to 2008 Newdale malt.

Table 6 – Quality data for 2009 harvest survey composite samples of CDC Kendall and Newdale malting barley

Origin of selected samples	Saskatchewan		CDC Kendall Alberta/Sask		Prairie Provinces[1]		Newdale Alberta	
Crop year	2009	2008	2009	2008	2009	2008	2009	2008
Thousands of tonnes	11	77	34	27	45	110	6	10
Barley								
Physical characteristics								
Test Weight, Kg/hL	65.8	n/a	67.5	n/a	67.1	n/a	66.8	n/a
1000 kernel weight, g	47.0	45.5	44.0	44.7	44.8	45.3	46.5	49.6
Heavy grade, over 6/64" sieve, %	97.4	95.8	95.8	95.7	96.2	95.8	94.8	97.0
Intermed grade, over 5/64"sieve, %	1.5	2.9	3.2	3.0	2.8	3.0	4.1	1.6
Chemical analysis								
Moisture, %[2]	12.6	11.3	10.0	10.9	10.7	11.2	12.1	12.7
Protein, %	10.6	11.8	11.2	11.8	11.1	11.8	11.1	10.5
Germination, 4 ml (3 day), %	100	98	100	99	100	99	100	100
Germination, 8 ml (3 day), %	99	87	88	88	91	87	91	99
Malt								
Physical characteristics								
Yield, %	94.3	93.4	94.2	92.5	94.2	93.2	94.7	92.9
Steep-out moisture, %	46.0	48.6	46.3	48.9	46.2	48.7	45.9	48.0
Friability, %	86.1	83.3	78.5	82.3	80.4	82.6	82.3	88.1
Chemical analysis								
Moisture, %	5.0	4.9	5.6	4.6	5.5	4.8	4.9	4.4
Wort								
Fine grind extract, %	81.2	79.8	80.3	80.1	80.5	79.8	79.4	80.5
Coarse grind extract, %	80.6	79.5	80.1	79.7	80.2	79.5	79.1	80.5
F/C difference, %	0.6	0.3	0.2	0.4	0.3	0.3	0.3	0.0
ß-Glucan, ppm	55	47	32	43	38	48	42	49
Viscosity, cps	1.40	1.42	1.41	1.43	1.41	1.42	1.40	1.43
Soluble protein, %	4.33	4.82	4.70	4.87	4.60	4.82	4.06	4.36
Ratio S/T, %	41.5	40.9	40.7	41.9	40.9	41.0	36.4	41.6
FAN, mg/L	151	193	166	208	162	195	128	168
Colour, ASBC units	1.62	2.17	1.78	2.61	1.74	2.24	1.79	2.21
Diastatic power, °L	164	157	199	154	190	157	127	94
α-amylase, D.U.	63.1	64.8	72.5	63.3	70.1	63.9	56.9	52.7
Rapid Visco Analysis, units	120	71	120	51	120	70	137	157

[1] Weighted average values

[2] Moisture not representative of new crop moisture levels as samples were not collected or stored in moisture-proof containers.

Legacy

The acreage and production volume of Legacy barley has started to decline in its growing area of the eastern Prairies. Legacy barley composites received in 2009 had thousand kernel weight and plumpness levels that were similar to those of 2008 (Table 7). Protein levels were significantly lower than the levels of 2008. Germination energy levels were very good, with only slight levels of water sensitivity present.

The malt made from Legacy barley in 2009 was of good average quality. Fine extract levels were 0.5% higher than those of 2008 Legacy malt. Beta-glucan and viscosity levels were similar to those of 2008 malt. Protein modification was moderate, with FAN and wort colour levels lower than those of 2008. Diastatic power and alpha amylase levels were similar to those in 2008 Legacy malt. Malt of good quality can be made from Legacy barley grown in 2009.

Table 7 – Quality data for 2009 harvest survey composite samples of Legacy malting barley.

Origin of selected samples	MB/Sask	Saskatchewan		Alberta	Prairie Provinces[1]	
Crop year	2009	2009	2008	2009	2009	2008
Thousands of tonnes	40	28	136	2	70	143
Barley						
Physical characteristics						
Test Weight, Kg/hL	64.8	65.5	n/a	64.0	65.1	n/a
1000 kernel weight, g	38.8	40.4	40.7	37.2	39.4	40.6
Heavy grade, over $^{6}/_{64}$" sieve, %	92.6	94.5	93.1	89.5	93.3	93.1
Intermed grade, over $^{5}/_{64}$" sieve, %	5.8	4.3	5.0	9.1	5.3	5.0
Chemical analysis						
Moisture, %[2]	10.5	12.8	10.8	11.7	11.5	10.9
Protein, %	11.0	11.1	12.0	10.2	11.0	12.0
Germination, 4 ml (3 day), %	99	99	99	100	99	99
Germination, 8 ml (3 day), %	87	92	92	89	89	92
Malt						
Physical characteristics						
Yield, %	94.4	94.9	93.7	94.7	94.6	93.7
Steep-out moisture, %	45.1	45.3	47.3	44.2	45.1	47.4
Friability, %	76.7	72.4	79.5	77.5	75.0	79.4
Chemical analysis						
Moisture, %	5.3	4.8	5.0	4.9	5.1	4.9
Wort						
Fine grind extract, %	79.1	78.7	78.4	79.4	78.9	78.4
Coarse grind extract, %	78.4	77.9	77.7	78.6	78.2	77.7
F/C difference, %	0.7	0.8	0.7	0.8	0.7	0.7
ß-Glucan, ppm	276	417	328	314	333	322
Viscosity, cps	1.45	1.50	1.47	1.47	1.47	1.47
Soluble protein, %	4.72	4.54	4.88	4.11	4.63	4.89
Ratio S/T, %	43.5	42.1	40.6	42.3	42.9	40.6
FAN, mg/L	185	179	209	158	182	209
Colour, ASBC units	1.89	1.97	2.00	1.74	1.92	2.02
Diastatic power, °L	177	158	163	137	168	163
α-amylase, D.U.	67.3	62.3	59.8	63.0	65.2	59.8
Rapid Visco Analysis, units	124	130	83	152	127	82

[1] Weighted average values

[2] Moisture not representative of new crop moisture levels as samples were not collected or stored in moisture-proof containers.

Tradition

Tradition barley is now being grown and selected in significant quantities on the Prairies (Table 8). Selected composites of Tradition barley had average quality, with similar levels of plumpness and kernel weights than in 2008. Protein levels were good, averaging nearly 0.5% lower than those of 2008. Germinative energy levels were reasonably good, however, dormancy affected both the 4ml and 8ml test levels. Barley colour and staining was moderate.

Malt made from selected composites of Tradition barley in 2009 was of good average quality. Extract levels were slightly higher in 2009 compared to those of 2008. Wort beta-glucan levels were slightly elevated, possibly due to dormancy, as suggested by water sensitivity of barley composites. Protein modification levels were lower than those of 2008, due partly to lower barley protein levels and lower modification. Wort colour levels were moderate, significantly lower than levels of 2008 Tradition. Diastatic power and alpha-amylase levels were good, similar to those of 2008. Tradition malt analysis data presented here is affected somewhat by a malting schedule not optimized for 6 rowed malting barley, and by the dormancy which is a characteristic of the variety.

Table 8 – Quality data for 2009 harvest survey composite samples of Tradition malting barley

Origin of selected samples	MB/Sask	Saskatchewan		Prairie Provinces[1]	
Crop year	2009	2009	2008	2009	2008
Thousands of tonnes	8	9	91	17	95
Barley					
Physical characteristics					
Test Weight, Kg/hL	66.5	66.4	n/a	66.5	n/a
1000 kernel weight, g	39.7	41.4	40.1	40.6	40.1
Heavy grade, over 6/64" sieve, %	94.2	96.0	94.1	95.2	94.0
Intermed grade, over 5/64"sieve, %	4.4	3.1	4.1	3.7	4.2
Chemical analysis					
Moisture, %[2]	11.4	12.4	10.8	11.9	10.8
Protein, %	11.7	11.7	12.1	11.7	12.2
Germination, 4 ml (3 day), %	100	91	98	95	98
Germination, 8 ml (3 day), %	85	89	88	87	88
Malt					
Physical characteristics					
Yield, %	94.6	95.2	94.1	94.9	94.1
Steep-out moisture, %	45.9	45.3	47.7	45.6	47.8
Friability, %	63.9	63.8	67.4	63.9	67.3
Chemical analysis					
Moisture, %	5.2	4.9	4.9	5.0	4.9
Wort					
Fine grind extract, %	78.5	78.4	78.3	78.5	78.2
Coarse grind extract, %	77.6	77.3	77.2	77.5	77.1
F/C difference, %	0.9	1.1	1.1	1.0	1.1
ß-Glucan, ppm	213	352	369	287	358
Viscosity, cps	1.47	1.51	1.51	1.49	1.50
Soluble protein, %	4.32	4.24	4.55	4.28	4.55
Ratio S/T, %	36.9	36.1	37.0	36.5	36.8
FAN, mg/L	154	151	179	152	179
Colour, ASBC units	1.57	1.54	1.64	1.55	1.64
Diastatic power, °L	184	171	169	177	169
α-amylase, D.U.	54.3	47.9	49.1	50.9	49.0
Rapid Visco Analysis, units	149	150	143	149	142

[1] Weighted average values

[2] Moisture not representative of new crop moisture levels as samples were not collected or stored in moisture-proof containers.

Methods malting barley

This section describes methods used at the Grain Research Laboratory. Unless otherwise specified, analytical results for barley and malt are reported on a dry weight basis. The ASBC methods cited are those of the American Society of Brewing Chemists, Ninth Edition, (2009).

α-amylase activity

α-Amylase activity is determined using ASBC method MALT 7B automated to run on a Skalar segmented flow analyser, using ASBC dextrinized starch as the substrate, and calibrated with standards that have been determined by method ASBC Malt 7A.

Beta-Glucan content

Beta-Glucan content is determined in malt extract by Skalar segmented flow analysis using Calcofluor staining of soluble, high molecular weight ß-glucan (ASBC Wort-18).

Diastatic power

Diastatic power is determined on a Skalar segemented flow analyzer, using an automated neocuproin assay for reducing sugars, which is calibrated using malt standards analysed using the official ferricyanide reducing sugar method, (ASBC Malt 6A).

Dockage and assortment

Dockage - Dockage-free barley is obtained by passing an uncleaned sample through a Carter Dockage Tester arranged as described in the Canadian Grain Commission's Official Grain Grading Guide for dockage determination. This involves passing the barley over a #6 riddle, #6 and #5 Buckwheat sieves. Material retained above the #5 sieve is considered to be dockage-free.
Assortment - All samples are passed through a Carter Dockage Tester equipped with a No. 6 riddle to remove foreign material and two slotted sieves to sort the barley. Heavy Grade barley is the material retained on a 6/64" (2.38 mm) x 3/4" slotted sieve. Intermediate Grade is barley that passes through the 6/64" x 3/4" sieve but is retained on a 5/64" (1.98 mm) x 3/4" slotted sieve.

Fine-grind and coarse-grind extracts

Extracts are prepared using an Industrial Equipment Corporation (IEC) mash bath and the Congress mashing procedure from 45°C to 70°C. Specific gravities are determined at 20°C with an Anton Paar DMA 5000 digital density meter (ASBC Malt-4).

Free Amino Nitrogen (FAN)

Free amino nitrogen is determined on the fine extract according to the official ASBC method Wort-12, automated to run on a Skalar segmented flow analyzer.

Germination energy

Germination energy is determined by placing 100 kernels of barley on two layers of Whatman #1 filter paper, in a 9.0 cm diameter petri dish, and adding 4.0 ml of purified water. Samples are controlled at 20 degrees Celcius and 90% relative humidity in a germination chamber. Germinated kernels are removed after 24 and 48 hours and a final count is made at 72 hours (ASBC Barley 3C, IOB, and EBC procedure).

Kolbach index (ratio S/T)

Kolbach index is calculated from the formula, (% Soluble protein/% Malt protein) x 100.

Malting conditions

Malts are prepared using an Automatic Phoenix Micromalting System designed to handle twenty-four 500 g samples of barley per run. Samples were steeped at 13°C using the following regime; 10 hour wet steep, 18 hour air rest, 8 hour wet steep, 12 hour air rest. Samples were germinated for 96 hours at 15°C, with 100% relative humidity. Kilning was carried out over 24 h as follows: 12 hours at 60°C; 6 hours at 65°C; 2 hours at 75°C; 4 hours at 85°C.

Malt mills

Fine-grind malt is prepared with a Buhler-Miag disc mill set to fine-grind. Coarse-grind malt is prepared with the same mill set to coarse-grind. The settings for fine- and coarse-grinds are calibrated quarterly, based on the screening of a ground ASBC standard check malt (ASBC Malt-4).

Moisture content of barley

Moisture content of barley is predicted using NIR equipment that has been calibrated by the standard ASBC method (ASBC Barley 5C).

Moisture content of malt

Moisture content of malt is determined on a ground sample by oven drying at 104°C for 3 hours (ASBC Malt-3).

Protein content (N x 6.25)

Protein content is predicted on dockage-free barley using NIR equipment that has been calibrated by Combustion Nitrogen Analysis (CNA). CNA is determined on a LECO Model FP-428 CNA analyser calibrated by EDTA. Samples are ground on a UDY Cyclone Sample Mill fitted with a 1.0-mm screen. A 200-mg sample is analysed as received (it is not dried prior to analysis). A moisture analysis is also performed and results are reported on a dry matter basis (ASBC Barley 7C).

Rapid Viscometric Analysis

The degree of pre-germination in barley was determined as described by Izydorczyk (2005); see the CGC website at www.grainscanada.gc.ca. Click on Grain research tab on left side, scroll down to technologies . There find project report: Prediction of germination energy of malting barley during long term storage. Grain Research Lab, Canadian Grain Commission, Winnipeg, Canada. Samples were analyzed using the RVA-4 (Newport Scientific) and the Stirring Number Program. Final viscosity values were presented in Rapid Visco Units (RVA).

Viscosity

Viscosity is measured on fine grind Congress wort using an automated Schott AVS 500 Micro-Ubbelodhe glass capillary viscometer, which has been calibrated according to ASTM method D-445 (ASBC Wort-13).

Water sensitivity

Water sensitivity is determined exactly as described for germination energy, except that 8.0 ml of purified water is added to each petri dish (ASBC 3C, IOB and EBC procedure). The actual water sensitivity value is the numerical difference between the 4ml and 8ml tests. (Note: the water sensitivity value is not reported in the data tables but is inferred by inclusion of the result of the 8 ml test).

Weight per thousand kernels

A 500 gram sample of dockage-free barley is divided several times in a mechanical divider to obtain two equal portions of 40 grams. All foreign material and broken kernels are removed from one 40 gram portion and the net weight determined. The number of kernels is then counted with a mechanical counter and thousand kernel weight is calculated (as is basis) (Institute of Brewing's Recommended Methods of Analysis, Barley 1.3 (1997)).

Wort-soluble protein

Wort-soluble protein is determined spectrophotometrically using ASBC method Wort-17.

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